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SOIL CORROSION OF PIPE LINES

At the request of the water department of Wichita Falls, Tex., and with the cooperation of the Cast Iron Pipe Research Association, K. H. Logan, chief of the Bureau's underground corrosion section, is making a special survey of corrosion experienced in the vicinity of that city. The shortage of iron and steel has accentuated the need for reducing corrosion of pipe lines as much as possible. The most promising method at present seems to be the imposition of negative electrical potentials on a line which is to be protected. There are two ways of doing this, one by drawing energy from a regular power line, the other by connecting to the pipe line zinc slabs buried at intervals in the earth. The first method is in widespread use in Texas, and a very extensive installation of zinc anodes has been in use in southern Colorado for a number of years. The Petroleum Industry Electrical Association and a number of pipe-line organizations have asked for cooperation in determining the effectiveness of these two methods in the field, and Mr. Logan will also consider this aspect of the problem.

PERFORATED COVER PLATES FOR STEEL COLUMNS

An investigation of the characteristics of steel columns with perforated cover plates was started at the Bureau about 2 years ago, and some early results were given in Technical News Bulletin No. 302 (June 1942). Progress reports in the Journal of Research have dealt with: The program and test methods (RP1473); compressive properties of plates having ovaloid perforations of the following width-to-thickness ratios of 40 (RP1474), 68 (RP1501), and 53 (RP1514); compressive properties of plates having circular perforations and a width-to-thickness ratio of 53 (RP1527); and compressive properties of plates having a net-to-gross cross-sectional area ratio of 0.33 (RP1540).

The latest results of this work are reported by Martin Greenspan in the December Journal of Research (RP1568), in which he derives formulas for the over-all lengthening or shortening of a tension or compression member having a uniform gross cross section and a series of similar perforations of circular, elliptical, or ovaloid shape uniformly spaced along its length. Tests made on strips having circular perforations show that the applicable formula gives good results over the practical range of the variables.

STANDARD STEEL SAMPLES FOR SPECTROGRAPHIC ANALYSIS

In conformity with its policy of adding new varieties of standard samples

[1] Published with approval of the Director of the Budget.

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to its stock as industrial developments warrant, the Bureau is now prepared to furnish a number of steels in rod form suitable for controls in spectographic analysis. The 18 standards now available were selected for checking important representative points of composition among several types of carbon and low-alloy steels. The values of the concentrations are sufficiently well distributed in most cases to provide analytical curves for Mn, Si, Cu, Ni, Cr, V, and Mo.

The standards are issued in two sizes: (1) Cylindrical rod 7/32 inch in diameter, 4 inches long (approximately 22 g); and (2) cylindrical rod ½ inch in diameter, 2 inches long (approximately 50 g). The standards are numbered in consecutive order in two series, the first beginning with 401 for the 7/32-inch rods and the second beginning with 801 for the ½-inch rods. The standards may be ordered by number from the National Bureau of Standards, Washington, D. C., at a price, per sample, in either series, of $3, irrespective of the number of samples ordered. The identifications and compositions of the standards are given in the provisional certificate, which is reproduced below.

SPECTROGRAPHIC STEEL STANDARDS

Standards [1]	Name	Mn	Si	Cu	Ni	Cr	V	Mo	Al
401, 801	B. O. H., 0.4 C [2]	0.34	0.015	[3]	0.005	0.015	------	------	------
402, 802	B. O. H., 0.8 C	.46	.060	0.025	.010	.025	------	------	------
403, 803	A. O. H., 0.4 C	.89	.25	[4] .16	.23	.28	0.045	0.060	------
404, 804	Basic electric	------	.35	.21	------	.043	------	.006	------
405, 805	Medium manganese	1.38	.19	.12	.15	.18	.010	[4] .010	------
406, 806	Chromium-vanadium	.71	.24	.10	.080	.97	.23	.005	------
407, 807	Chromium-vanadium	.79	.29	.090	.15	1.15	.19	.035	------
408, 808	Chromium-nickel	.62	.22	.12	1.21	.64	------	------	------
409, 809	Nickel	.45	.13	.080	3.24	.20	------	------	------
410, 810	2 Cr-1 Mo	.38	.30	.11	.13	2.30	[4] .004	.97	------
411, 811	Cr-Mo (SAE X4130)	.65	.14	.065	.29	.91	.003	.15	------
412, 812	Cr-Mo (SAE 4130)	.60	.22	------	------	.66	------	.20	------
413, 813	A. O. H., 0.4 C	.67	.22	.25	.18	.055	.007	.006	------
414, [5]	Cr-Mo (SAE 4140)	.67	.26	.11	.080	.99	.003	.32	------
415, 815	Bessemer, 0.4 C	1.12	.093	------	.010	.010	.007	------	------
416, 816	Cr-Mo-Al (Nitralloy G)	.48	.25	.14	------	.127	.003	.16	1.06
417, 817	A. O. H., 0.4 C	.64	.18	------	.105	.028	.004	------	------
418, 818	Cr-Mo (SAE X4130)	.52	.28	------	.11	.96	------	.22	------

[1] Standards in the 400 series are rods 7/32 inch in diameter, 4 inches long, and standards in the 800 series are rods ½ inch in diameter, 2 inches long.
[2] The carbon contents of the 18 steels lie between 0.1 and 0.8 percent.
[3] Dashes in the table indicate elements not certified for spectrographic analysis.
[4] New values.
[5] This standard is not available in the ½-inch size.

TEMPERATURE-CONTROL EQUIPMENT

Although temperature-control equipment can be purchased, the securing of such equipment may be attended by difficulties. In order to insure that work will not be delayed it is frequently desirable to improvise from units already at hand.

In certain work of the Bureau's fire resistance section it is necessary to control accurately the temperature of a piece of electrically heated equipment. The controlling thermocouple is connected in series with a potentiometer and a mirror-type galvanometer. The heating current is set at a value that would heat the equipment beyond the desired temperature if continuously applied. When its temperature goes beyond the desired limit, the potentiometer becomes unbalanced and the galvanometer reflects a beam of light on a photoelectric cell, the induced current in which is amplified in an electron tube to operate a telephone relay which in turn operates a relay in the power circuit. This introduces additional resistance into the power circuit, resulting in a lower temperature of the equipment controlled. When its temperature drops to the desired limit, the relays release and the higher heating current is on until the beginning of the next cycle. A temperature of 400° C was maintained in one equipment within 1/100° C.

NEW ALTITUDE CHAMBER FOR TESTING AERONAUTICAL INSTRUMENTS

Present-day aerial warfare is carried on at very high altitudes. This has greatly increased the need for testing aircraft instruments and apparatus at temperatures and pressures encountered

at altitudes above 30,000 feet. This is particularly true of apparatus for testing oxygen equipment, because at altitudes above 10,000 feet it is necessary that the pilots be supplied with oxygen, and their lives depend upon the reliable functioning of the controlling mechanism. To meet this need a new altitude chamber has been constructed at the Bureau. The chamber, which is cylindrical with a shallow dome at each end, is 78 inches in diameter by 116 inches high. It stands with the cylinder upright. A door opening 24 by 77 inches is provided. Three window ports and a tool lock are installed. The chamber is lined inside with 4 inches of cork for thermal insulation. This is necessary to enable the refrigeration unit to lower the temperature to —50° C, a temperature which is not uncommon at the high altitudes at which fighting is now taking place. The pressure can be lowered by a vacuum pump far below the pressure at any altitude attainable by present airplanes.

BASIC IONIZATION CONSTANT AND pH VALUES OF METACRESOLSULFONPHTHALEIN

A paper (RP1569) by Elizabeth E. Sager, Harry J. Keegan, and S. F. Acree, appearing in the December Journal of Research, reports a series of spectral transmittancy curves and the corresponding acidity (pH values) obtained for the indicator metacresolsulfonphthalein in various solutions of acids and salts. Indicators are used for practical test and control of acidity and alkaninity in biological and industrial processes, and it is important to have accurate pH standards and methods for such purposes. The Bureau has in progress the selection and purification of indicators, acids, and salts suitable as "pH standards" and is determining their pH values at various temperatures. These compounds can be used for calibrating colorimetric and electrometric equipment and for test and regulation of acidity in research laboratories, factories, or field stations.

Metacresolsulfonphthalein (1.25×10^{-5} *M*) in 0.001- to 1-*M* hydrochloric acid gives stable color standards varying from yellow to red, and their spectrophotometric absorption indices are useful in computing the pH values between 0 and 3.

pH VALUES OF ACID-SALT MIXTURES

A potentiometric method for determining whether or not the dissociation of strong acids or bases is essentially complete is described in a paper by Walter J. Hamer, Gladys D. Pinching, and S. F. Acree (RP1567) in the Journal of Research for December. The method is illustrated by data on *p*-phenolsulfonic and 4-chlorophenol-2-sulfonic acids. Measurements are made of the electromotive forces of hydrogen–silver-silver-chloride cells without liquid junction containing aqueous mixtures of the free acid and its sodium or potassium salts, to which known weights of potassium or sodium chloride have been added. The activity coefficients of hydrochloric acid in the mixtures are then calculated from the electromotive forces. The acid is completely dissociated into ions if the activity coefficients thus calculated are higher than those predicted by the limiting law of Debye and Hückel and is incompletely dissociated if they are lower. By this criterion it was determined that the sulfonic acid groups of *p*-phenolsulfonic and 4-chlorophenol-2-sulfonic acids are completely dissociated into hydrogen and sulfonate ions.

Also given are the pH values of aqueous solutions of p-phenolsulfonic acid mixed with its sodium or potassium salt and sodium or potassium chloride, and of 4-chlorophenol-2-sulfonic acid mixed with its sodium salt and sodium chloride, for temperatures of 10°, 25°, 40°, and 60° C. The pH values of these solutions range from 1.2 to 2.6 and vary only slightly with changes in temperature; increasing at the rate of 0.00025 to 0.00045 pH unit per degree, depending upon the concentration of the solutions. They have a buffer capacity of approximately the same magnitude as mixtures of hydrochloric acid and sodium chloride. The solutions may be prepared from known weights of pure hydrochloric acid and the dry salts recrystallized from distilled water. These solutions may be used for the accurate calibration of assemblies for determining the pH of solutions of high acidity, such as leather extracts, solutions of chromic acid, chrome tanning liquors, and lead-storage-battery fluids. They may also be used in the pH control of industrial processes, such as electroplating, that are carried out in solutions of high acidity.

The degree of dissociation of acidic and basic groups in indicators has a practical bearing on their use in determining the pH values of solutions. As the sulfonic acid group is considered to be completely ionized, the color of a sulfonated indicator is independent of the degree of neutralization of this radi-

cal but not of weak phenolic and amino groups in the chromophores.

LIST OF PUBLICATIONS ON HOME BUILDING AND MAINTENANCE

A revised list of published material relating to home building and maintenance has just been prepared. This is designated as Letter Circular LC737, replacing LC647, which appeared in May 1941. The list is intended to be of assistance to home builders and owners and all others interested in materials, equipment, and practices employed in the construction of dwellings and in the maintenance and modernization of these structures. This is not merely a list of Bureau publications; it includes papers issued by other agencies of the Federal Government and by national trade associations and organizations, in which materials, equipment, and recommended methods of applying them are described. No responsibility, however, is assumed by the Bureau for statements made in outside publications by others than members of its own staff.

In addition to the sources mentioned in the list, many universities and colleges, through their engineering and experiment stations, agricultural extension divisions, and other departments, publish pamphlets of interest to home owners. The Letter Circular includes the names and addresses of these institutions.

The publications, whatever their source, are grouped under subjects which are arranged alphabetically, beginning with "brick" and ending with "wood." In all, there are 29 of these major headings, each of which includes many entries. Sources of publications are likewise arranged alphabetically under each subject heading.

Those having a definite need for this list should write to Building Practice and Specifications Section, National Bureau of Standards, Washington 25, D. C., asking for a copy of LC737. No charge is made for this Letter Circular.

NEW AND REVISED PUBLICATIONS ISSUED DURING NOVEMBER 1943

Journal of Research [2]

Journal of Research of the National Bureau of Standards, volume 31, No. 5, November 1943 (RP1563 to RP1566, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

Research Papers [2]

[Reprints from the October 1943 Journal of Research.]

RP1558. The assay of potassium p-phenolsulfonate, its pH range, and its ultraviolet absorption spectrum. Elizabeth E. Sager, Marjorie R. Schooley, and S. F. Acree. Price 5 cents.

Technical News Bulletin [2]

Technical News Bulletin No. 319, November 1943. Price 5 cents. Annual subscription, 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having a definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

LC735. Sources of radio information. (Supersedes LC611.)

RECENT ARTICLES BY MEMBERS OF THE BUREAU'S STAFF PUBLISHED IN OUTSIDE JOURNALS [3]

A survey of combustion research. Ernest F. Fiock. Frontiers of chemistry (Interscience Publishers, 215 Fourth Ave., New York, N. Y., 2, 1 (1943). (Part of a bound book on the chemical background for engine research).

Fundamentals of optical engineering. Donald H. Jacobs. Book of 487 pages (McGraw-Hill Book Co., 330 West 42d St., New York, N. Y.) (November 1943).

Determining the flashpoints of heavy-bodied paints by the Tag closed cup and Pensky-Martens testers. David Busker. ASTM Bul. No. 124, 13 (American Society for Testing Materials, 260 South Broad St., Philadelphia, Pa.) (October 1943).

Chemical thermodynamics of hydrocarbons. Frederick D. Rossini. Frontiers of Chemistry. 2, 55 (1943).

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[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents a year; Journal of Research, $3.50 a year (to addresses in the United States and its possessions and in countries extending the franking privilege); other countries, 70 cents and $4.50, respectively.

[3] These publications are not obtainable from the Government, unless otherwise stated. Requests should be sent direct to the publishers.